DOCUMENT RESUME

ED 263 873 IR 011 857

AUTHOR Steil, Toni L.

TITLE Tutorials for Software: A Comparison of the Appleworks Software Tutorial with Pre-Entered Data and an Experimental Tutorial with User Entered Data.

PUB DATE Apr 85

NOTE 22p.; Paper presented at the Annual Meeting of the Western Psychological Association (San Jose, CA, April 18-21, 1985).

PUB TYPE Reports - Research/Technical (143) -- Tests/Evaluation Instruments (160) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC01 Plus Postage.

DESCRIPTORS *Computer Assisted Instruction; *Computer Software; Educational Strategies; Higher Education; *Man Machine Systems; *Microcomputers; Questionnaires; Statistical Significance; Student Attitudes; Teaching Methods

IDENTIFIERS Appleworks Software Tutorial; Instructional Effectiveness; *Spreadsheets; *Tutorial Mode

ABSTRACT

A study was devised, using 20 undergraduate students chosen at random from an introductory psychology course, to measure the teaching effectiveness of two computer tutorials oriented to the spreadsheet portion of Appleworks. The first tutorial provided a data disk with pre-entered data for the user to manipulate, but no error correction information; the second, which included error correction information, required users to set up a spreadsheet format using a given example, then to enter their own data, and finally to manipulate the data using the program functions. Tutorials were evaluated on four dependent variables: (1) measure of time taken to use them; (2) user satisfaction ratings taken from questionnaires; (3) errors made as measured after completion of the tutorial; and (4) requests for assistance from the experimenter. Results indicate a significantly higher rating for use of the experimental tutorial, which required the user to enter the data, over the manufacturer's tutorial with its data disk; comparable time was spent on task measurements, although subsequent errors were more frequent during the use of the manufacturer's tutorial; and those utilizing the manufacturer's tutorial required more assistance from the experimenter than did the experimental group, suggesting that the experimental tutorial provided clearer instructions. The software tutorial questionnaire and scoring criteria are appended. (JB)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED263873

U.S. DEPARTMENT OF EDUCATION
NATIONAL INSTITUTE OF EDUCATION
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)
☒ This document has been reproduced as received from the person or organization originating it.
☐ Minor changes have been made to improve reproduction quality.
• Points of view or opinions stated in this document do not necessarily represent official NIE position or policy.

Tutorials for Software:

A Comparison of the Appleworks Software Tutorial with Pre-entered Data and an Experimental Tutorial with User Entered Data

Toni L. Steil

University of the Pacific

Running head: SOFTWARE TUTORIALS in computer use

IR011857

BEST COPY AVAILABLE

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY
Toni L. Steil
TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

Tutorials for Software:
A Comparison of the Appleworks Software Tutorial with Pre-entered Data and an Experimental Tutorial with User Entered Data

Within the past decade, human factors engineering has been used successfully to address human interaction with computer systems. There has been a recent expansion of this focus to include "software psychology" i.e., the human performance limitations associated with the design and use of the software rather than (or in addition to) the hardware (cited in Kearsley & Hillelsohn, 1982, p. 74).

This change in direction from hardware to software is most prolifically seen in the vast amount of research done with computer assisted instruction (CAI) in the educational setting (Kearsley et al, 1982; Clement, 1981). However, there is little research relating to other types of application software (Lawton & Gerchner, 1982).

The commercial software industry is a multimillion dollar business. Thousands of software packages are sold every month and a greater proportion of society is coming to rely on their word processing software for letters or spreadsheet software to balance bank accounts.

BEST COPY AVAILABLE

Consequently, there is a need to explore the software aspect of the computer system more fully when considering the extent of it's use in non-educational settings.

One context of application software which warrents attention is the question of how the user goes about learning to use the software. The traditional documentation/manual approach has recently been supplemented with tutorial programs and literature to aid in the learning process. However, little has been done to research the best applications of these tools (Clement, 1981).

Some have suggested that the human/computer interface should pay more attention to cognitive factors (Lipsitz, 1982; Clement, 1981) i.e., motivation and goals of the user (Lang, Auld, & Lang, 1982), confidence (Paxton & Turner, 1984), and attitudes (Lawton et al, 1982; Clement, 1981).

To incorporate such cognitive factors, Gagne in an interview (as cited in Lipsitz, 1982) suggests that designers should be aware of cognitive learning theory in the organization of learning material. As such, the designer would be concerned with such internal processes as selective perception and semantic coding among others. Gagne asserts that the tutorial mode of teaching requires development as a new technology. And as a technique it

BEST COPY AVAILABLE

should especially incorporate drill and practice. Gagne states that according to modern cognitive theory, drill and practice "deserve more credit than most people give it".

Furthermore he asserts that the cognitive theories developed about such subjects as basic skills (i.e., reading, writing, and arithmatic) have proposed that for the learner to undertake the problem solving that is required when he or she solves arithmetic problems they must use their working memory which deals with the ability to acquire and retain information but which has a limited capacity. In order to carry out most effectively the processing that's required, some of the subordinate skills must be automatic.

Additionally it has been suggested by Kearsley & Hillelsohn (1982) that only the essential skills and knowledge necessary for the specific function in question should be presented in the material. Training materials should try to teach one primary objective or all objectives related to a particular subtask. Hence tutorials and other training materials should not abound in extraneous text or non-essential material not vital to the tasks to be trained. Such superfluous information can be confusing and tedious to the trainee, expecially considering only a portion of the material will be retained by the trainee. Conversely however, some tutorials miss one vital learning resource,

BEST COPY AVAILABLE

information required to correct errors (Davis & Swezey, 1983). In other tutorials, information regarding error correction is skeletal or non-existant. Novice users expecially, prefer learning situations which are enhanced with extensive help and error correction facilities (Benbasat & Wand, 1984). If the user has the ability to correct errors, then confidence is gained (Paxton et. al., 1984).

In other tutorials, information regarding error correction is skeletal or non-existant. Psychological factors such as confidence, attitudes and anxiety have been shown to affect the user's rate of learning as well as performance when working with computers. Specifically, it has been demonstrated that naive users with negative attitudes towards computers learned editing tasks more slowly and made more errors (Schniederman, 1979). Eason and Damodaron (1981) have also lent support to the importance of attitude and its effect on the nature of the user, expecially the naive user's interaction with the computer. Their belief is that the naive user's attitude towards computers affects their motivation in working with the computer. Eason and Damodaron assert that while a negative attitude toward computers may result in the user exaggerating small problems into large ones, a postive

BEST COPY AVAILABLE

attitude may result in the user being motivated to deal with small problems he or she encounters with the computer. The implication then, is for designers to create computer systems and related materials that will help instil positive attitudes towards the system.

Schniederman (1979) has suggested that anxiety may reduce short-term memory and impair performance. Consequently, when designing a system for users (especially novices) it is recommended that every effort be made to make the user feel at ease without being too obvious or patronizing. Hence, instructions should be clear, in familiar terms, and easy to follow, and should begin with simple tasks that will enable the user to be successful and gain confidence.

Mayer in 1967 (as cited in Paxten, et. al. p. 146) has stressed that a lack of efficient and effective training techniques is one of the naive user's difficulties in achieving maximum interaction with the computer. Mayer proposed an automated training subsystem. Each subsystem would encorporate tutorial features produced by the computer, which would always be available to the user for training. This system would be based on a shaping priniciple where the tutorial material would be presented in small incremental steps requiring frequent responses from

BEST COPY AVAILABLE

the learner and enabling the learner to progress at his or her own speed. One of the benefits discussed by Mayer (1967) of such a training system included the fact that the trainee learns the system by actually using the system, and that successful use of a computer has a strong motivational effect.

While cognitive factors are receiving some attention in relation to computer interaction and design of associated materials (i.e., tutorials) more attention also needs to be directed towards the choice of tasks that are most beneficial for the user to learn. The present study suggests that a crucial phase in teaching a user, new to a software program, is to include the tasks of data entry and screen design in the tutorial. In the interest of expediancy for the user though, some software tutorials are bypassing these tasks by providing a diskette containing pre-entered data. It is recommended that the effectiveness of such a tutorial may be hampered, especially if the user chooses to immediately take his new found skill taught by the tutorial and attempts to use the software. The user would likely find that he could not even begin because he hasn't practiced the skills required for the first steps - screen design, and data entry. It has been documented (Paxton et al, 1984) that successful use of the computer

BEST COPY AVAILABLE

after training will produce a strong motivational effect and absence of this crucial step could lead to a negative experience for the user instead of the enrichment the user should be experiencing.

Two tutorials were tested in the present study. One tutorial (A) provided a data disk with pre-entered data for the user to manipulate, and no error correction information. The other tutorial (B) did not include a data disk and encompassed features of data entry and screen design provided by the user from given sample data, and use of error correction information. Both were oriented to the spreadsheet portion of Appleworks and evaluated on the dependent variables of a) measures of time taken to use them, b) user satisfaction ratings taken from the questionnaires, c) errors made as measured after completion of the tutorial, and d) requests for assistance from the experimenter. Both tutorials are comparable and required nearly identical user manipulations of the data. The only substantive difference between them is the method of data entry and the absence or inclusion of error correction information. It was expected that those in the tutorial B group would achieve higher satisfaction ratings, fewer errors, and fewer requests from the experimenter than those

BEST COPY AVAILABLE

in group A. It was also expected that the time taken to complete each of the tutorials would be relatively equal.

Method

Subjects

The participants in the present study were 20 undergraduate students (10 male, 10 female). The participants were chosen at random from a group of volunteers (N=75) from a university introductory psychology course (N=105). The participants were randomly assigned to two groups (group A using the manufacturer's tutorial and group B using the experimental tutorial). The two groups were found to be demographically similar in that the average age for both groups was 18.8 years, the average year in college for each group was 1.8 years, and randomization of the original 20 participants to the two groups produced equal numbers of males and females for each group (males=5, females=5).

There were some differences between the two groups in the amount of prior computer experience the subjects had before the study. Group A had an average of 5.9 months experience while group B had an average of 8.9 months experience. A Chi-square test demonstrated a statistical

BEST COPY AVAILABLE

difference between the two group's previous experience levels ($\underline{X}^2(9)=128.15$, one-tailed, $p<.005$).

Apparatus

The spreadsheet portion of the Appleworks software tutorial was utilized. Currently this software is sold with a tutorial and an accompanying data disk used in conjunction with the written tutorial. This tutorial and data disk were given to subjects in group A. Group B was given a second tutorial written for the same software using similar spreadsheet functions, but written by the experimenter. While both tutorials are similar, the basic difference is in their approach to the data. The manufacturer's tutorial (used by group A) provides for various manipulations of the data using the program functions, but the data used is already stored on a data disk so that the user need only access this disk to begin. The other experimental tutorial (used by group B) does not include a prepackaged data disk but instead requires the user to set up a spreadsheet format using a given example, then to enter their own data, and finally to manipulate it using the program functions.

 BEST COPY AVAILABLE

All the participants used the Apple IIe computer with 128 K memory, two disk drives, a monitor, and an interactive software tutorial developed by Apple to help introduce users to the computer entitled, An Introduction to the Apple IIe computer, Apple Presents... Apple (copywrite 1982).

A 20 item 7-point likert scale questionnaire (see appendix A) was given to each participant upon completion of their respective tutorial. The questionnaire was designed to measure a subject's level of confidence and level of satisfaction toward the tutorial and toward the software. The extreme points of the scale represented bipolar attitudinal statements with (1) being the most positive response and (7) being the least positive. Several of the statements were scored slightly differently (see appendix B).

Procedure

The present study was conducted in a small comfortable, sound attenuating room 7 feet by 15 feet, located in the university psychology department. Lighting was provided by three 150 watt soft flood lights, one located directly above the computer. Subjects were led to the computer room and seated near the computer. All subjects were given identical

BEST COPY AVAILABLE

instructions provided by one female experimenter and each worked independently. The subjects were then given basic operating instructions (i.e., how to turn the computer on and off). They were then instructed to go through the introductory disk (Apple Presents... Apple). The use of this disk was meant to provide that each subject would have a common base understanding of computer use.

Subjects were then told that while going through their respective tutorial, if they reached a point where they felt they could not proceed, that they may then request assistance from the experimenter.

The dependent variables consisted of; a) the duration of time, measured in minutes and seconds, used to complete the tutorial, b) a rating of each subject's level of satisfaction and confidence level toward the tutorial used via the questionnaire, c) the frequency of errors that were made on the sample data as viewed on the screen (screen errors) after the subject had finished their respective tutorial, and d) the frequency of subject requested assistance from the experimenter.

Results

A t-test applied to the survey score ratings (DV b) of the two groups indicated a significant difference between

BEST COPY AVAILABLE

the two groups ($t(18) = 3.97$, one-tailed, $p<.005$). The mean scores for the survey ratings were 55.2 for group A and 33.6 for group B (lower scores represent a more positive rating). Both groups had a comparable time to completion average (x = 43.4 min. for group A, x = 42.8 min for group B) which were not statistically different. Table 1 illustrates the raw data gathered for the two groups.

Table 1

Outcome Measures for Both Groups

		Dependent Variables			
		a) Time Measures (Minutes)	b) Questionnaire Ratings	c) Screen Errors	d) Requested Assists
Group A	mean	43.4	* 55.2	8.3	3.0
	range	29.0	57.0	36.0	5.0
standard deviation		9.9	19.7	10.7	1.3
Group B	mean	42.8	* 33.6	.3	1.4
	range	35.0	27.0	2.0	4.0
standard deviation		13.1	9.6	.5	2.0

* Lower scores represent more positive ratings

Of the screen errors determined after completion of the tutorial, group A had an average of 8.3 errors and group B had an average of .3 errors. A Chi-square test demonstrated

 BEST COPY AVAILABLE

a significant difference between the two groups ($\underline{X}^2(9)=1196.35$, one-tailed, $p<.005$). The range for errors found in group A was from 0 errors to 36 errors.

Question 15 on the survey revealed the subject's view on whether data should be provided on disk for use with the tutorial (see appendix B) and question 14 asked whether the information should be manually entered during use of the tutorial (see appendix B). Group A responded more positively than group B on question 14 ($x = 2.2$ for group A and $x = 3.3$ for group B). Both groups were comparable on their view of whether a data disk should be provided (question 15) ($x = 3.2$ for group A and $x = 3.8$ for group B). Responses from both groups for questions 14 and 15 were not found to be significantly different.

Measures taken of the frequency in which users felt they could not continue their task and requested assistance from the experimenter revealed a significant difference between the two groups ($\underline{X}^2(9)=147.4$, one-tailed, $p<.005$). Group A required a total of 30 assists while group B required a total of 14 assists.

BEST COPY AVAILABLE

Discussion

The results shown on the survey scores indicate a significantly higher rating for use of the experimental tutorial (used in group B) over the manufacturer's tutorial (used in group A). Questions in the survey covered enjoyment, understandability, usefulness, confidence levels and ease of use of the tutorials. Since the groups had comparable time on task measurements and the screen errors were so much more frequent during use of the manufacturer's tutorial, it can be concluded that the experimental tutorial provided a more accurate, more enjoyable teaching experience for the user.

The screen error measures are of particular interest because screen design, entering data and manipulation of that data would logically have produced more errors than simple manipulation of pre-entered data. This is because there are far more user behaviors involved in screen design and entering data and therefore are more opportunities for errors to be made. However the opposite proved the case. The manufacturer's tutorial which required fewer user

BEST COPY AVAILABLE

behaviors produced more screen errors than the experimental tutorial. It is also interesting to note that the group using the manufacturer's tutorial required significantly more assistance from the experimenter than did the experimental group. This evidence could suggest that the experimental tutorial provided clearer instructions.

Additional research might explore whether the nature of the experimental tutorial (oriented from the natural beginning of the task which is screen design and data entry) over the nature of the manufacturer's tutorial (which began the task with pre-entered data, deleting the more rudamentry behaviors of screen design and data entry) might have been part of the reason the experimental tutorial had superior results. The evidence found in this study suggests that all of the behaviors the user would naturally engage in while using the software should be included when preparing software tutorials and that deleting any of these behaviors could be counterproductive.

It is also of interest to note that while both groups rated use of manual data entry higher than use of the pre-entered data, the manufacturer's tutorial users (group A) rated use of a manual data entry format even higher than those in the experimental group (group B). This might

BEST COPY AVAILABLE

suggest some dissatisfaction in the use of totally pre-entered data when used with a software tutorial.

The results obtained in the present study support the experimenter's hypothesis that when provided with a tutorial learning approach to a software package, it would be more appropriate to apply the natural user procedures of formatting the screen and providing data entry rather than bypassing these steps for the sake of ease to the user and providing pre-entered data.

There is need for other research coming from those interested in software psychology with goals concerning the development of introductory methods for software programs.

Several issues which could warrent research in this regard are; the organization of the tutorial, error handling, determining the most effective modes of introduction to software (i.e., tape recording or video tape), and attention to the heterogeneous nature of commercial application software users. Finally, a better documentation developer/user dyad should be established to orient documentation and tutorials more toward actual user characteristics. For example actual software users might be integrated into the software development process.

BEST COPY AVAILABLE

DATE_____

QUESTIONNAIRE

NAME_____ SEX M F AGE _____

EXPERIENCE WITH COMPUTERS_____ MOS. ____ YRS.

YEAR IN SCHOOL_____ MAJOR_____

PLEASE CIRCLE THE NUMBER THAT MOST CLOSELY DESCRIBES YOUR FEELINGS.

1. I _____ enjoy(ed) using this manual.

1_____2_____3_____4_____5_____6_____7
greatly moderately did not

2. I found the manual _____ .

1_____2_____3_____4_____5_____6_____7
to be a useful teaching too. not too useful in terms of training

3. I feel that I could begin using the spreadsheet _____ .

1_____2_____3_____4_____5_____6_____7
with little additional training after considerably more training

4. I _____ that this manual needs improvement.

1_____2_____3_____4_____5_____6_____7
do not feel very much feel

BEST COPY AVAILABLE

5. This manual has given me _____ of use of the spreadsheet in general.

1_____2_____3_____4_____5_____6_____7
a greater understanding ... little understanding

6. The uses to which a spreadsheet could be put _____ .

1_____2_____3_____4_____5_____6_____7
is very evident to me now ... is not very evident yet

7. I was confused _____ of the time while using this manual.

0%_____50%_____100%

8. I feel _____ in my ability to start using this spreadsheet right away.

1_____2_____3_____4_____5_____6_____7
very confident ... not too confident

9. This type of software has _____ in terms of widespread use.

1_____2_____3_____4_____5_____6_____7
great possibilities ... few possibilities

10. I felt _____ while I used this manual.

1_____2_____3_____4_____5_____6_____7
nervous ... calm

11. I wish the manual _____.

1_____2_____3_____4_____5_____6_____7
had been longer ... had been shorter

BEST COPY AVAILABLE

12. I felt the amount of time it took to use this tutorial manual _____.

1_____2_____3_____4_____5_____6_____7
took too long — was quite appropriate — was too brief

13. How would you change this manual if you could?

14. I feel that entering my own data is (would be) _____ in creating confidence in use of the spreadsheet.

1_____2_____3_____4_____5_____6_____7
important — not important

15. I feel that having the data already entered on a data disk is (would be) _____ in making me confident in using this spreadsheet myself.

1_____2_____3_____4_____5_____6_____7
more useful — less useful

16. This manaul was _____ helpful in making me feel confident with my ability to use the spreadsheet.

1_____2_____3_____4_____5_____6_____7
very — not very

17. I would _____ use this type of manual when I am learning new software programs.

1_____2_____3_____4_____5_____6_____7
not like to — like to

18. I was _____ satisfied with my performance in going through the tutorial manual.

1_____2_____3_____4_____5_____6_____7
quite — somewhat — not very

19. Comments I would make about this manual are:

BEST COPY AVAILABLE

Additional Questionnaire Scoring Criteria

The anchors to questions 10 and 17 (see appendix A) were reversed such that (7) was the more positive response and (1) was the least positive, to reduce the chances of the respondant patterning toward one side of the questionnaire. In addition questions 11 and 12 (see appendix A) were oriented to obtain information about the respondant's attitude of the size of the tutorial and in this case a rating of (4) for these questions signified a most positive response. Questions 13 and 14 (see appendix A) requested general narrative information regarding the participant's attitudes toward the software tutorial.

BEST COPY AVAILABLE